

est mechanical appliances and automatic brake attachments.

At Hilo the company has erected complete blacksmith, foundry, wood-working, machine and other shops, and supplied with up-to-date mechanical appliances for turning out the rolling-stock of the company. Adjacent to the works the company has erected a number of cottages for its employees.

Near Puna, which is the present terminus of the system on its main line, are the extensive plantations of the Puna Plantation Company, as likewise a number of beautiful warm springs and mountain lakes, surround-

ed by a wealth of natural tropical verdure, and backed by a magnificent and equable climate. These warm springs are noted for their wonderful curative qualities, particularly to those who are afflicted with rheumatism. The erection of a fairly good-sized, properly-conducted hotel near these springs would not only prove a valuable adjunct to the railroad system, but a matter of necessity for tourist travel and local people.

Adjoining the Olaa Plantation lands on the mauka side are thousands upon thousands of acres of land that when once clear-

ed of its natural tropical growth, and populated by a class of desirable settlers, will be made highly productive.

The main object of the Hilo Railroad Company in penetrating the district of Olaa was primarily for the purpose of creating an outlet and encouraging the opening up and settlement of these lands and connecting them with the milling plant of the Olaa Plantation, the city of Hilo and its magnificent harbor.

The system was originally intended, and is now conducted, as a public road, and, although transacting at the present time

an extensive business with the plantations, will be conducted in a most liberal manner for the people relative to freight rates and passenger travel, and will be the finest-equipped road in the Hawaiian Islands.

Following is the list of officers:

B. F. Dillingham, President.
L. A. Thurston, Vice President.
M. P. Robinson, Treasurer.
A. W. Van Valkenberg, Secretary.
W. M. Graham, Auditor.
W. H. Lambert, Superintendent.
C. H. Kluegel, Engineer.

Sugar Properties of the "Garden Isle," KAUAI.

THE Island of Kauai, which is termed the "Garden Isle," has of late years come forward and added her quota to the sugar product of the group. At this time the island is principally devoted to the cultivation of sugar, although in some sections rice is extensively raised.

The development of water upon the island for irrigating the vast areas of sugar cane, is being rapidly pushed forward. Geologically it is the oldest island in the Hawaiian group, and in about the center of the island it is very mountainous, forming a splendid water shed.

From these mountains the land rolls gently to the ocean, while several majestic streams wend their way to the sea. There are several important plantations on the island of Kauai, and the present indications are very favorable for a largely increased sugar output for the future, beginning with the season of 1902.

New mills are being erected upon several plantations and taking the industry as a whole the outlook is exceedingly bright. Communication with this island is practically uninterrupted, made by the steamers of the Inter-Island Steamship Company, on an average of five days a week.

It was at Koloa, on this island, that the first sugar mill was erected, which consisted of wooden rollers propelled by oxen with whaler's trying-out pots for rolling the sugar. It is needless to state that the mill extraction of the sucrose contained in the cane was not very high.

Kekaha Sugar Company

In the category of prosperous plantation properties on the island of Kauai appears the Kekaha Sugar Company's estate at the place of the same name. It consists of Government and former Crown land leaseholds under sub-lease from V. Kaudsen of Waimea upon shares. The first cane was planted upon the lands in 1880 by Faye and Meyer and was all of the Lahaina variety. H. P. Faye commenced planting in 1883 in Mana, which lands latterly developed into the most extensive portion of the present company's holdings.

The Kekaha Sugar Company, Limited, was formed in 1898 and now controls an area of 2000 acres all planted in Lahaina cane, extending from Kekaha to Poehale, a distance of two miles and varying in width from one-fourth to three-fourths of a mile.

The general character of the soil is deep red loam, black adobe and marsh lands. The average annual rainfall is so limited that irrigation is resorted to, the supply of water being obtained from artesian wells. Two pumping plants have been erected, fitted with the Risdon high-duty pumps with an average daily output of 18,000,000 gallons. There is another pumping plant, making three in all. The cane is planted at elevations ranging from thirty-five to 90 feet.

For plowing the lands two sets of Fowler's steam tackle are in use, although some plowing is performed by ordinary plows and mules. Here, like many plantations, the cane is ripe and ready for the mill in from eighteen to twenty months.

The 1901 crop is from 300 acres of plant and 1000 acres of long and short ratoons. In the cultivation of the soil from 1500 to 1800 pounds of high-grade fertilizer and nitrate of soda is used to the acre, the latter greatly stimulating the growth of the cane. The total sugar output of the mill for the season of 1900 from 1108 acres of plant and ratoon canes, part of the latter very old, was 9017 tons. The general average of ratoons, however, is 7 1-2 tons of sugar to the acre, and of plant cane 9 1-2 tons.

The method of transporting the cane from field to mill is by rail, there being maintained some fifteen miles of permanent and three miles of portable trackage, and the rolling stock consisting of 334 cane cars with an average capacity of 2 1-2 tons, sixteen sugar cars and four locomotives.

Some 650 skilled and unskilled laborers are employed upon the plantation, most of the labor being carried on by day work, with the exception of the cane cutting, loading and unloading of cane cars, which are done by a profit-sharing system. The laborers, in addition to their wages, receive house room fuel, water and medical attendance.

The company does not maintain a hospital of its own, but contributes to the support of the Waimea hospital, the various plantation managers of the district being trustees. Besides, the company supports the foreign church at Waimea.

A complete nine-roller mill made by the Honolulu Iron Works has been installed, the rollers being 32 x 60, and the cane being fed through a Krajewski crusher.

The hydraulic pressure on each three-roller mill is as follows, which varies somewhat according to the fibre of the cane, etc.: No. 1 mill, 250 tons; No. 2 mill, 275 tons, and No. 3 mill, 300 tons. The mill is operated seventeen hours a day, during which

time from forty to forty-five tons of sugar is turned out.

The principal apparatus which has been installed consists of two quadruple effects, six filter presses, two Honolulu Iron Works and one German vacuum pans with total striking capacity of eighteen tons, open clarification system with carbonic acid gas process, thirteen centrifugals and the necessary pumps and other appliances, etc.

The mill is driven by a large Hamilton-Corliss engine, steam being generated by the use of the bagasse or cane trash. Water for condensing purposes is obtained from artesian wells upon the place.

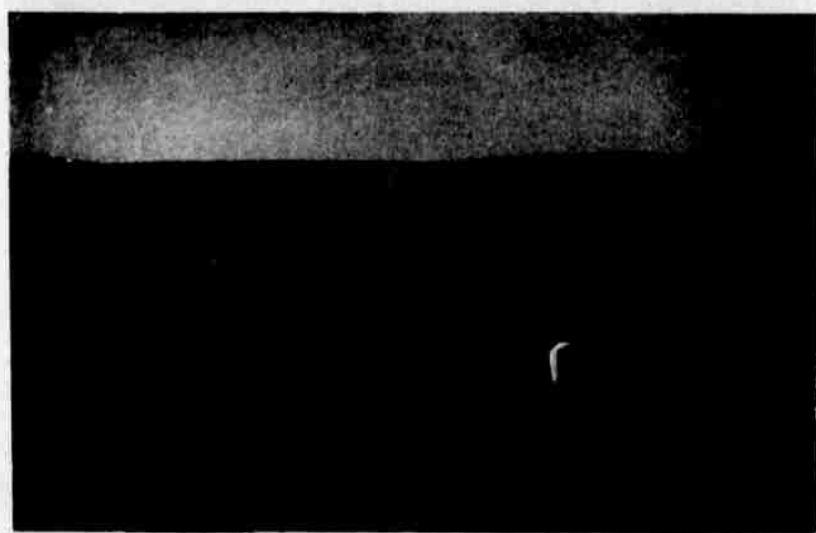
The company has its own lime kiln and manufactures its own carbonic acid gas as well as lime for clarification and building purposes, etc.

Adjoining the mill building are the machine shop, electric light plant and general offices of the company. In addition, the company maintains its own telephone system, using portable instruments. Only one grade of sugar is manufactured, which is known as the "A" grade, all the low-grade sugars and molasses being worked over. The mill was erected by the Honolulu Iron Works Company of Honolulu and is comparatively a new mill, this being only the second season that it has been operated.

The sugar product when ready for shipment is conveyed from the mill to the landing at Waimea by rail, from whence it is shipped to Honolulu and loaded direct into vessels for the Pacific Coast and the East. E. K. Bull is manager of the plantation and has been identified with the sugar industry for fully fifteen years.

Following is the list of officers and directors of the Kekaha Sugar Company:

G. T. Wilcox, President.
H. P. Faye, Vice President.
H. A. Isenberg, Treasurer.
F. Klamm, Secretary.
A. S. Wilcox, Auditor.



Method of Planting Cane on Lands of Hawaiian Sugar Company, Island of Kauai
(PHOTO BY WILLIAMS, HONOLULU)

Waimea Sugar Mill Co.

The Waimea Sugar Company, Limited, is one of the small but dividend-paying properties on the island of Kauai, the total acreage being only 400 acres, of which area 300 acres have been planted to the Lahaina variety of cane, although some experiments are being carried on by the management with the Rose Bamboo and Yellow Caledonia.

About one-third of the area in cane is plant, the balance being ratoons, while the highest elevation that cane is planted is 100 feet. The soil is a red loam, the method of preparing same for planting being ordinary plowing with mules. The method of cultivation is hilling up, fertilization and irrigation.

The rainfall from October, 1899, to October, 1901, was forty-two inches. Water supply for irrigation purposes is from wells, the water being lifted by the aid of Risdon high-duty compound pumps.

In transporting the ripened cane to the mill two miles of main and one mile of portable track are in use, supplied with thirty cars with a capacity of five tons to each car. All the cane on this plantation matures in from fifteen to eighteen months, as it does not tassel.

Under favorable conditions the cane will run six tons of sugar to the acre, or fifty tons of cane to the same area, varying of course in some seasons.

The average number of laborers upon the plantation is only 110, most of the labor being performed under the co-operative system. Fertilization is carried on, using about one-half ton to the acre. Upon the place are some twenty-five head of horses and mules.

The cane as it is brought to the mill is dropped onto the endless carrier, passing to one 3 and one 2-roller mills, with a capacity for turning out twelve tons of raw sugar in twelve hours. The mill was erected by the Honolulu Iron Works, and consists of open clarification system, triple effect, two Honolulu pans, centrifugals driven by separate power, and much other machinery. The bagasse is used for fuel, as is the case in other mills. Only one grade of sugar is manufactured, all the low grade sugars and molasses being worked into the A or No. 1 grade. The annual or season's output of sugar is 1000 tons, but owing to heavy fertilization the company expects to increase the output in the future.

At the mill the company has a warehouse with a capacity for holding 3000 bags. The sacked sugar is conveyed by cars to the landing at Waimea, a short distance away, and shipped direct to Honolulu.

John Fassoth is manager of the plantation and has been here for eighteen years. First as sugar boiler, then engineer and now manager. He has been identified with sugar in the islands since 1882.

Following is the list of officers of this company:

J. B. Atherton, President.
H. W. Schmidt, Vice President.
E. D. Tenney, Secretary.
W. A. Bowen, Treasurer.
E. P. Chapin, Auditor.
Castle & Cooke, Agents, Honolulu.

Hawaiian Sugar Co., Ltd.

The Hawaiian Sugar Company, Limited, is one of the prosperous plantations on the island of Kauai, its headquarters being located at Makaweli, where the first cane was planted, under the co-operative system in the '90s by the present company.

The total area is approximately 50,000 acres,

are allowed the privilege of raising vegetables.

The carrying out of the daily performance of labor incident to the successful operation of the plantation is by two systems, one-half of the labor working under a co-operative or profit-sharing system, and being known as company men or contractors, while the balance are day laborers who are simply paid so much a month for twenty-six working-days.

About 225 mules and horses are required in the general plantation work, which are given excellent care.

The average yield of sugar from all cane fields now under cultivation is between six and seven tons of sugar to the acre, but the plantation has had fields that yielded much heavier than this.

Upon the plantation has been erected a diffusion mill for the manufacture of raw sugar, having a capacity for turning out 110 tons of raw sugar in a day of twenty-four hours, and is the only mill of the kind now in successful operation in the Hawaiian Islands. This mill is identical in construction with that of a beet sugar mill. The cane is fed from the usual carrier to large revolving drums, which are supplied with a series of knives, which slice the cane to a one-eighth part in thickness, and the cane is then elevated from the knives to the mill by a system of carriers supported with a series of rakes to what is known as battery cells, there being two batteries of fourteen cells each, having an individual capacity for holding 6000 pounds of cane. These batteries are supplied with water, which is heated to 130 degrees Fahrenheit. From here the process of extraction of sugar begins and is carried on until the sugar is sacked and ready for shipment.

The mill is supplied with the Deming apparatus, one 20 and one 30-ton vacuum pans, twenty 32-inch Watson & Laidlaw centrifugals, and much other machinery. There have been installed 10 boilers of 100 horsepower each, while three Putnam engines run all the pumps. The bagasse from the batteries is fed by an endless carrier to a roller mill for the purpose of reducing the moisture, and is then fed automatically to the furnaces and utilized as fuel. The mill extraction by this system is given at 96 to 97 per cent. The relative cost of operation, when compared with the modern nine-roller mills, is not ascertainable.

Connected with the mill are the machine and blacksmith shops, where all repair work is done. Adjacent to this is the locomotive round-house, etc. The company operate their own ice and electric light plant, the entire mill and grounds being supplied with a system of incandescent lights. In the still greater development of the plantation the company are about to enter into a water proposition of great magnitude, which consists in conveying by means of a flume and ditch system of great length a supply of water for irrigation purposes that will be equal to any amount that will ever be demanded. Surveys have already been made for the bringing in of the supply from the mountains and some work of construction has been done in a small way.

With the above supply of water the company will rapidly extend their cane area and bring under cultivation much good cane land.

Like other plantations the Hawaiian Sugar Company has had its share of labor troubles, but, on the whole, everything is moving along fairly well, and the cane is looking very fine. Following is the list of officers and directors of the company:

H. P. Baldwin, President.
W. M. Giffard, Vice President.
J. P. Cooke, Treasurer.
W. L. Hopper, Secretary.
W. G. Taylor, Auditor.
Robert Catton, Director.

McBryde Sugar Company

The property of the McBryde Sugar Company's extensive plantation is located on the island of Kauai and comprises approximately 17,000 acres, of which area about 8000 acres may be considered as well adapted for cane culture, while the remainder of the area is about equally divided between pasture and forest lands. According to surveys made of the lands adapted for sugar cane, there is nominally 5000 acres below the 400 foot elevation and the remaining area being between the 400 and 1000-foot elevations, all of which has a most beautiful slope to the south and all under the company's irrigation system.

Since the acquisition of the above property, some two years ago, which consisted of the estates known as the Koloa Agricultural Company, the Eleele plantation and the Wahiawa ranch, together with all the appurtenances thereon, with slight reservations, much work of a permanent character has been completed. This plantation extends from the Koloa landing on the east to and into the Hanapepe valley on the west, a distance of eight miles, with no intermediate lands held by outsiders excepting a few acres here and there which are leased for a nominal rent per year. These lands

which lands are held under a 50-year lease from Gay & Robinson, and extend from Waimea Gulch to Hanapepe Valley, a distance of several miles. That portion of the area in Hanapepe Valley in former Crown land.

Practically the entire area is under cultivation, and planted principally to the Lahaina cane, although a small area is given over to Caledonia, Striped Singapore canes, etc. The growing crops are about equally divided between plant and ratoon canes, and the management aims to plant about a thousand acres each year.

The land has a gentle slope from the sea, the soil being a reddish loam carrying pyroxide of iron. The method of preparing the soil for planting is by the use of two sets of Fowler steam tackle, while the method of cultivation is by fertilization and irrigation. The water supply for irrigation purposes is obtained from Hanapepe Valley stream, which flows to the lands by gravity.

The method of transporting cane to mill is by a complete railway system, which consists of some twelve miles of main and portable field tracks, while the equipment comprises 400 cane cars having an average capacity of from three and one-half to four tons of cane, while three Baldwin locomotives propel the cars to and from the mill.

In the development of the property some 1000 skilled and unskilled laborers are employed, who occupy several camps adjacent to their work, where have been erected better houses and better camps for the accommodation of the men and their families than is usually found upon the majority of plantations.

The laborers receive in addition to their wages, which average \$20 per month, house room, fuel, water and medical attendance, and have little patches of land where they